Brain organoids as a model system for human neurodevelopment and disease.

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Public Summary:
This manuscript provides a critical review of current advances in modeling disease using brain organoids derived from stem cells.

Scientific Abstract:
The ability to reproduce early stages of human neurodevelopment in the laboratory is one of the most exciting fields in modern neuroscience. The inaccessibility of the healthy human brain developing in utero has delayed our understanding of the initial steps in the formation of one of the most complex tissues in the body. Animal models, postmortem human tissues and cellular systems have been instrumental in contributing to our understanding of the human brain. However, all model systems have intrinsic limitations. The emerging field of brain organoids, which are three-dimensional self-assembled multicellular structures derived from human pluripotent stem cells, offers a promising complementary cellular model for the study of the human brain. Here, we will discuss the initial experiments that were the foundation for this emerging field, highlight recent uses of the technology and offer our perspective on future directions that might guide further exploratory experimentation to improve the human brain organoid model system.